What is claimed is:

1. A near field microscope comprising:

a wave source, which emits a wave with a variable frequency;

a waveguide resonator through which the wave emitted from the wave source propagates;

a probe, which perforates an outer wall of the waveguide resonator and by which the wave that propagates through the waveguide resonator interacts with a sample; and

a detector, which detects the wave that has interacted with the sample.

2. The near field microscope of claim 1, further comprising a tuner, which is movably connected to one end of the waveguide resonator and adjusts a length of the waveguide resonator.

3. The near field microscope of claim 1, wherein a portion of the probe inside the waveguide resonator has a linear shape.

4. The near field microscope of claim 1, wherein a portion of the probe inside the waveguide resonator has a loop shape.

5. The near field microscope of claim 1, wherein a probe portion outside the waveguide resonator has a linear shape or a loop shape.

6. The near field microscope of claim 1, wherein the probe is formed of metal, a dielectric material, or a magnetic substance.

7. The near field microscope of claim 4, wherein when H_0 is a maximum value of a magnetic field perforating the portion of the probe inside the waveguide resonator, **p** is a p-value in a TE_{10P} mode, z_i is a position of a front end of the portion of the probe inside the waveguide resonator, z_f is the position of a rear end of the portion of the probe inside the waveguide resonator and **d** is a length of

the waveguide resonator, a magnitude of an electromotive force generated in the probe is given by:

$$V = -\frac{\mu_0 j\omega a y H_0}{\pi}[2\cos\frac{1}{2}\{\frac{p\pi}{d}(z_f + z_i)\}\sin\frac{1}{2}\{\frac{p\pi}{d}(z_f - z_i)\}].$$

8. The near field microscope of claim 7, wherein the probe is disposed in a position that satisfies z_f=3d/2p, z_i=d/2p.

9. The near field microscope of claim 5, wherein a slit is formed in the waveguide resonator, and the probe is movable along the slit.

10. The near field microscope of claim 1, wherein when a width of a cross-section of the waveguide resonator is **a**, a height of the waveguide resonator is **b,** and **m** and **n** are integers, a cut-off frequency f_{cmn} of the waveguide resonator is given by:

$$f_{cmn} = \frac{1}{2\pi\sqrt{\mu\varepsilon}}\sqrt{(\frac{m\pi}{a})^2 + (\frac{n\pi}{b})^2},$$

and a wave with a frequency greater than the cut-off frequency is used.

11. The near field microscope of claim 1, wherein, when a resonance frequency and a volume before the probe is inserted into the waveguide resonator are f_0 and v_0, respectively, and a change in volume of the probe after the probe is inserted into the waveguide resonator is Δ v , a change in resonance frequency **f** of the waveguide resonator is given by:

$$\frac{f - f_0}{f_0} = -\frac{2\Delta v}{v_0}.$$

12. The near field microscope of claim 1, wherein the probe is a hybrid probe manufactured using partial two-step etching.

13. The near field microscope of claim 1, further comprising a lock-in amplifier, which minimizes noise by improving a signal-to-noise ratio between the wave source and the waveguide resonator.

14. The near field microscope of claim 1, wherein the wave source emits microwaves or millimeter-waves.

15. The near field microscope of claim 1, wherein when a wavelength of the wave emitted from the wave source is λ , the length of the waveguide resonator changes by λ /4 increments.

16. The near field microscope of claim 4, wherein the probe portion having the loop shape is disposed parallel to an advancing direction of the wave.